FOREST PEST MANAGEMENT
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AN EVALUATION OF PEST CONDITIONS IN THE PRIORITY FUELWOOD SALE, ARROWHEAD RANGER DISTRICT, SAN BERNARDINO NATIONAL FOREST

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ABSTRACT

The Tunnel 2 Ridge area was examined for pest conditions to provide supporting information for the proposed Priority Fuelwood Sale and to provide background documentation for the Forest Management/Integrated Pest Management demonstration project. Several pest organisms were observed. These included western dwarf mistletoe and western pine beetle in ponderosa and Coulter pine, sugar pine dwarf mistletoe and Armillaria root disease in sugar pine, true fir mistletoe and fir engraver in white fir, and annosus root disease in the pines and fir. Oak true mistletoe was observed in California black oak. Foliar symptoms indicative of ozone injury were present on some ponderosa pine. The locations of the more important of these pests are documented on a map.

Four management alternatives are discussed; the no action alternative, commercial thinning, commercial and precommercial thinning, and thinning plus patch cuts. The effect of these alternatives on mortality levels and their effectiveness in reducing future pest impacts are discussed. In addition, pest-specific prevention and suppression techniques for annosus root disease, pine engravers, and dwarf mistletoes are presented.

INTRODUCTION

On August 15, 1983 we met with Norm Nass, Resource Forester, Arrowhead Ranger District, and visited the proposed Priority Fuelwood Sale area on Tunnel 2 Ridge (T.2N., R.3W., sections 7 and 18). The District is considering thinning the area through a commercial fuelwood sale. In addition, the area will become part of the Southern California Forest

Management/Integrated Pest Management demonstration project. The silvicultural objective for the area is to attain a mixed species (at least 30% oak), all-aged stand with brush occupying about 10% of the area in patches up to 1/4-acre in size.

Timber harvesting occurred in the area through the 1950's, with the last cutting of live trees in 1958. Subsequently, most of the cutting has been for salvage, although some live trees have been removed along road 2N34 to provide a shaded fuelbreak.

OBSERVATIONS

Overstory species include ponderosa pine, Coulter pine, sugar pine, white fir, and California black oak. The same species can be found in the understory along with canyon live oak and a few incense-cedars. Manzanita is the primary brush species. Stocking levels were measured at selected locations and basal areas ranged from 40 to 440 ft^2/ac.

During our evaluation we did not attempt to do a 100% survey of the sale area. Observations were made along transects distributed throughout the area. From these observations we were able to estimate approximate boundaries of dwarf mistletoe infections and the locations of other pests more limited in occurrence, such as bark beetles and root disease. The various pests observed and their locations are noted on the enclosed map.

Fomes annosus is one of the principal pests currently affecting all conifer species. It is more prevalent in ponderosa and Coulter pines, but some windthrow of root-rotted white fir was also seen. Many of the annosus root disease centers were initiated in the 25+-year-old stumps and now occur as small openings in the stand with only oaks and some conifer regeneration present. Many of these same centers have no recent mortality associated with them.

A large area of ponderosa and Coulter pines is infested by western dwarf mistletoe, Arceuthobium campylopodum. Several smaller pockets of this pathogen also were found. The degree of infection varies considerably from scattered infected individuals to pockets of heavily infected overstory and understory. Sugar pine dwarf mistletoe, Arceuthobium californicum, was also observed infecting sugar pine. The heaviest infection levels of A. californicum were found in the southeastern portion of the stand, although an isolated pocket is present in the western extension.

At the present time, bark beetle related mortality is low, probably in part because of the normal to above normal precipitation during the past two years. Western pine beetle, Dendroctonus brevicomis, was found in ponderosa and Coulter pines, with the red turpentine beetle, D. valens, attacking in the base of the trees. The mountain pine beetle, D. ponderosae, was observed in one sugar pine, also with D. valens in the base. The fir engraver, Scolytus ventralis, was involved with dead and top-killed white fir. The roundheaded fir borer, Tetropium abietis, was also associated with the white fir mortality.

Two species of true mistletoe were observed in the stand. Phoradendron bolleanum ssp. pauciflorum is present in the white fir. Although it is usually found in the tops of trees, in some of the more heavily infected areas even the boles and branches of understory white fir are infected. The most heavily infected area is in the southern and western part of the stand, but infected trees can also be found in the eastern section. The other true mistletoe, P. villosum ssp. villosum, occurs on black oak. None of the trees are severely infected. Although canyon live oak is a reported host of this parasite, it was not observed to be infected in any part of the stand.

Several other pests are present in the sale area. Elytroderma deformans was observed at low levels in some ponderosa pine branches. Infection levels were not high enough (40% or more of the crown infected) to cause significant damage. Armillariella mellea had infected and killed two sugar pine saplings on one site. No dead or declining oaks were present in the vicinity, but some large oaks were present that may have had some dead roots sufficient to support the fungus. In addition, ozone from the L.A. basin is causing foliar injury to many of the trees, most notably the ponderosa pine. Various levels of sensitivity were observed with some trees severely affected, while others had only minor symptoms.

MANAGEMENT ALTERNATIVES

1. No Action. Present levels of mortality in the Tunnel 2 Ridge stands are below what can "normally" be expected (0.1 trees/acre/year) in unmanaged stands. However, the insect and disease conditions described above are such that if no management action is taken, annual mortality levels will likely be higher than are currently being experienced. During years of below normal precipitation, levels could be considerably higher, a consequence of the increased stress on trees already affected by disease, primarily annosus root disease and dwarf and true mistletoes. Less vigorous, suppressed and stressed trees will also be more susceptible to successful bark beetle attacks. Tree stress induced by drought and overstocking alone, or interacting with disease-related stress, will increase susceptibility to bark beetles.

The mortality will occur both as individual trees (usually older, senescent overstory trees, as is currently the case) and increasingly more frequently in groups. The mortality groups will likely be located in overstocked aggregations, root disease centers, and in areas of heavy dwarf mistletoe infection. Group mortality of pines may include nearby healthy trees because of the ability of the western and mountain pine beetles to attract, by means of aggregating pheromones, large numbers of beetles sufficient to overcome the defensive mechanisms of even vigorously growing trees. Such mortality may cause parts of the stand to be understocked, create unplanned openings, and necessitate periodic entries for salvage or fuelwood cutting.

The activity of annosus root disease will continue in the sale area causing mortality and windthrow of conifers. Cutting newly-killed conifers may increase the incidence of F. annosus as additional stumps become infected. Because of the rapidity with which dead trees are felled and removed for firewood in the area, it was difficult to determine how active the fungus is in most of the disease centers. It appeared, however, that some of the centers may be reaching the end of their active life. Because most of these centers are at least 25 years old, it would not be suprising to see some of them die out in the next 5 to 15 years.

Both species of dwarf mistletoe will spread and intensify in the area. Intermediate and suppressed trees in the understory will be most severely affected. Continued exposure to infection from the overstory and reduced height growth from shading by the overstory will result in a buildup of the parasite in these trees, increasing stress and their probability of premature death. This will mean a loss of potential overstory replacements. Present members of the overstory will continue to be infected and witches' brooms will become greater nutrient drains on heavily infected individuals. As noted above, these heavily infected individuals will have a higher probability of successful bark beetle attacks and subsequent mortality.

True mistletoe in white fir can cause problems in some infected trees as infection levels increase. Most infections occur in the tops of trees which can lead to top-kill by the fir engraver. Subsequent attack by the fir engraver may continue down the bole causing tree mortality if other stresses, such as overstocking or drought, are present or if the amount of true mistletoe is quite high. New infections of true mistletoe will occur, usually in the tops of trees, especially those that are already infected. In the areas where true mistletoe is abundant, infections lower in the crowns and in the understory do exist and will occur. The height growth of the infected understory may be so impaired that it will have a difficult time ever reaching the level of the overstory.

2. Commercial Thinning. The objectives of this thinning would be to reduce stocking to desired levels and to sanitize the stand, removing as many diseased, stressed, or undesirable trees as possible. It would also partially regulate species composition. All trees to be removed would be 6 inches dbh and larger.

Under this alternative, trees heavily infected by dwarf or true mistletoe would be removed reducing the amount of inoculum to create new infections. However, removal of all dwarf mistletoe infected trees could leave an understocked stand in many areas. Tree selection in and around annosus root disease centers could encourage oaks and oak regeneration, as well as brush species. Implementation of this alternative would result in decreased mortality in future years as competition and moisture stress are reduced and would result in a general improvement of stand vigor. This would decrease the likelihood of attack by bark beetles.

If uneven-aged management is an objective for this stand, then some dwarf mistletoe-infected trees will be retained in order to maintain an adequate canopy cover. Infected residual trees will continue to cause new infections that could buildup to heavy levels, as well as spread to uninfested areas. In some areas of heavy dwarf mistletoe infection, the regeneration may be retarded in growth. Trees with numerous branch infections or bole infections may not respond to release and would function only to utilize soil moisture. If there are no non-hosts in the area, the future stand will be severely infected and many of the planned replacement trees may not reach the canopy.

3. Commercial and Precommercial Thinning. In addition to a commercial thinning as described under Alternative 2, a precommercial thinning of trees less than 6 inches dbh could also be done. This would improve stocking control, species mix, and sanitize the understory with the removal of dwarf and true mistletoe infected trees or trees with poor form or other undesirable characteristics.

The dwarf mistletoe problem would be reduced somewhat more than in Alternative 2 because of better control of species composition, but there would be continued infection of the understory from the overstory in some areas. Removal of many of the infected trees in the thinning operations would leave understocked and nonstocked areas in the stand.

4. Thinning and Patch Cuts. The thinning operations would be the same as Alternative 3, accomplishing sanitation, stocking, and species control. In areas heavily infected by dwarf mistletoe and in root disease centers, patch cuts up to a few acres (1-3) in size would be made removing susceptible host trees. Non-host trees could be retained. In annosus root disease centers these patch cuts could be regenerated with manzanita and black and live oak, thereby meeting wildlife objectives. Patch cuts in root disease centers would probably need to be no larger than 1/2-acre in size.

Attempting to remove all dwarf mistletoe-infected trees from the stand would result in large areas being understocked. However, selective removal of moderate and heavily infected individuals, especially in the overstory, and patch cutting areas with moderate or higher infection levels would decrease the impact of these pathogens. Although it would be preferable to regenerate these areas with non-hosts to eliminate the problem of reinfection, if the area is large enough the centers could be regenerated with a species mix including the host species, while a satisfactorily wide (100 feet) buffer of non-hosts around the margin of the cut would interfere with any reinvasion by dwarf mistletoe.

To the extent that this alternative results in the stand having the fewest number of stressed trees and thus should be best able to tolerate years with below normal precipitation, bark beetle-related mortality should be considerably reduced.

PEST SPECIFIC PREVENTION/SUPPRESSION CONSIDERATIONS

Regardless of the alternative(s) selected, it is important to implement the preventive actions of treating a) freshly cut conifer stumps with borax to prevent infection by Fomes annosus and b) green slash that accumulates to minimize any buildup of pine engravers that could affect the residual stand. Additionally, although dwarf mistletoe suppression is most effectively accomplished through timber harvesting, individual tree treatment may be justified on high value trees that are particularly desirable. In general, these would be special value trees that have dwarf mistletoe witches' brooms in the lower- and/or mid-crown. By pruning the witches' brooms from the tree, the life expectancy of the tree could be increased at least 10 to 20 years beyond what is expected if no treatment occurs.

Certain criteria should be followed if a witches' broom pruning is enacted. The intent is to remove the large witches' brooms, not infected branches.

1. Remove all brooms, not infected branches.

2. Leave at least 30% live crown ratio.

3. Do not prune trees which, after prunning, will have a mistletoe rating of 4 or greater.

PRIORITY FUELWOOD SALE
TUNNEL 2 RIDGE

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22. Annosus root disease in ponderosa pine - no mortality.

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27. Annosus root disease in ponderosa pine - no mortality.

28. Annosus root disease in ponderosa pine - no mortality.

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32. Annosus root disease in ponderosa pine - no mortality.

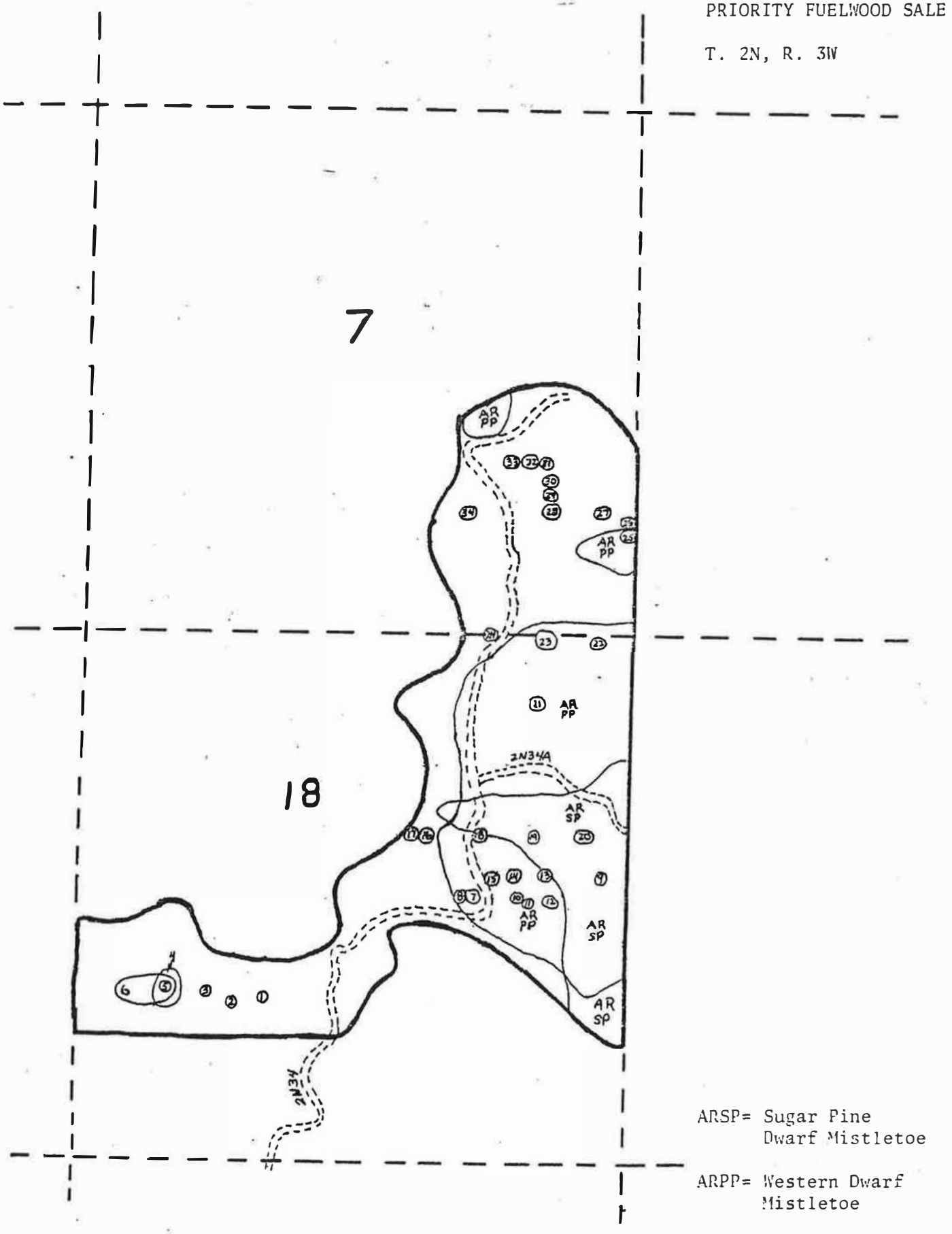
33. Annosus root disease in white fir - 1 dead fir.

34. Ponderosa pine killed by lightning and ponderosa pine neighbor infested by western pine beetle.

TUNNEL 2 RIDGE

PRIORITY FUELWOOD SALE

T. 2N, R. 3W



ARSP= Sugar Pine Dwarf Mistletoe

ARPP= Western Dwarf Mistletoe